WRITTEN REPLY

To Mr. Masaaki Moriuchi, Examiner at the Patent Office

1. Display of International Application
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5. Content of Reply

(1) Regarding the present application, we have received the PCT opinion as provided in accordance with article 13 (PCT regulation 66) of the law relating to, for example, international applications based on the Patent Cooperation Treaty, and we reply as follows.

(2) Regarding the invention of the present application

The invention according to claim 2 of the present application comprises the following configuration A and configuration B.

A: An optical element that comprises a substrate in which grooves are formed; wherein the expression: $380\ \text{nm} \leq (n - 1) \times d \leq 420\ \text{nm}$ is satisfied, where n is a refractive index of the substrate at a wavelength of

400 nm, and d (nm) is a depth per step of the grooves,

and

B: wherein the grooves are formed in four steps of depth d, depth 2d, depth 3d and depth 4d; and wherein the depth of the grooves is lined up in the order: depth 2d, depth 4d, depth d, depth 3d, or in the order: depth 3d, depth d, depth 4d, depth 2d.

By providing the configuration A, the invention according to claim 2 achieves "the effect that the light that is within the wavelength range 380 to 420 nm passes substantially through the dichroic hologram 28 can be obtained ". (Specification, page 53, lines 19 to 20[1]).

Next, the invention according to claim 2 of the application has grooves whose depth is in four steps, wherein the order of arrangement the grooves is not simply that in the order of the depth, but is changed to the order as described in configuration B.

By arranging the grooves in the order as given in configuration B, the light of wavelength λ2 (630 nm to 680 nm) experiences the grooves as grooves that deepen in a stepwise manner in the direction from the 2d side to the 3d side. (Specification Page 53 line 25 to Page 54 line 14[2]). Furthermore, with respect to the light of wavelength λ3 (780 nm to 820 nm), a diffraction efficiency in the order of 0.3 can be obtained when the depth of a single step is 0.5 times λ. (Specification Page 54 line 25 to Page 55 line 11[3]).

That is to say, according to the invention according to claim 2 of the present application, if the depth of the grooves is based on the standard wavelength of 400 nm, as in configuration A, and four step grooves are arranged in the order as in configuration B, then "the efficiency of the light that is diffracted can be further increased" (Specification Page 34 lines 13 and 14[4]) when light of a longer wavelength region is used.

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[1] Translators note: Corresponds to Page 52 lines 28 to 30 in the English translation.

[2] Corresponds to Page 52 lines 37 to Page 53 lines 17 in the English translation.

[3] Corresponds to Page 53 line 33 to Page 54 lines 10 in the English translation.

[4] Corresponds to Page 32 line 36 to 37 in the English translation.

(3) Difference to the cited inventions

(a) The apparatus described in Patent Document 1 is an apparatus that presupposes use of two types of laser light sources, of wavelength 650 nm and 785 nm, (Patent Document 1, paragraph [0008]), and configuration A of the present application is not described in Patent Document 1. Furthermore, the step-shaped portion of the diffraction grating described in Patent Document 1 is arranged in height order (FIG. 2 and 3 of Patent Document 1), and configuration B of the present application is not described in Patent Document 1.

(b) The apparatus described in Patent Document 2 is an apparatus that presupposes use of light of a wavelength not less than 450 nm (Patent Document 2, claim 3 and Table 1 to 10), and configuration A of the present application is not described in Patent Document 2. Furthermore, the step-shaped portion of the chromatic separation element described in Patent Document 2 is arranged in height order (FIG. 2 to 7 of Patent Document 2), and configuration B of the present application is not described in Patent Document 2.

(c) The wavelength that is used is not described in Patent Document 3, and neither is configuration A of the present application. Furthermore, the step-shaped portion of the diffraction grating is arranged in height order (Patent Document 3, FIG 4 for example), and configuration B of the present application is not described in Patent Document 3.

(d) It is mentioned in Patent Document 4 that the shortest wavelength that is used is 405 nm (Patent Document 4, paragraph [0011]). However, the step-shaped portion of the diffraction grating described in Patent Document 4 is arranged in height order (FIG. 4 of Patent Document 4), and configuration B of the present application is not described in Patent Document 4.

(e) It is mentioned Patent Document 5 that a first wavelength is 405 nm (Patent Document 5, paragraph [0025] line 10). However the step-shaped portion of the optical element described in Patent Document 5 is a two step configuration (FIG. 2 of Patent Document 5), and configuration B of the present application is not described in Patent Document 5.

(f) Patent Document 6 (Patent Document 6, paragraph [0012]) mentions a first wavelength of 400 to 410 nm. However the step-shaped

portion of the diffraction grating described in Patent Document 6 is arranged in height order (FIG. 4 of Patent Document 6), and configuration B of the present application is not described in Patent Document 6.

(g) Patent Document 7 (Patent Document 7, paragraph [0020]) mentions a first wavelength of 400 to 410 nm. However the step-shaped portion of the diffraction grating described in Patent Document 7 is arranged in height order (FIG. 4 of Patent Document 7), and configuration B of the present application is not described in Patent Document 7.

(h) Patent Document 8 mentions an example in which a first wavelength is 400 nm (Patent Document 8, paragraph [0041]). However there is no more specific description of the grooves or steps of the diffraction grating in Patent Document 8, and configuration B of the present application is not described in Patent Document 7.

(4) As described above, there is no disclosure of a configuration including configuration A or configuration B of the present application in Patent Documents 1 to 8, and neither is there disclosure of an increase of the diffraction efficiency due to the order of arrangement of the groove depth. Consequently, it is our belief that the invention according to claim 2 of the present application, and claim 4 and 5 of the present application that depend on this claim could not have not been easily invented based on the disclosure in Patent Documents 1 to 8.

Furthermore, the invention according to claim 7, 14 and 32 of the present application are also provided with configuration A and configuration B of the present application. Thus, it is our belief that the invention according to claim 7, 14 and 32 of the present application, and the invention according to claims 9 to 12 of the present application, claims 16 to 30 of the present application and claims 48 to 52 of the present application which cite those claims could not have been easily invented based on the disclosure in Patent Documents 1 to 8.